determining transmission of the transmitted radiation at each of the wavelengths; and

monitoring transmission, over time, to detect physical and/or chemical changes of the CMP slurry.

26. (Twice Amended) A system for evaluating chemical mechanical planarization (CMP) slurry quality in a process, comprising:

a light source generating a beam of electromagnetic radiation for transmission through a flow of [a] an undiluted optically dense slurry as used in a CMP process;

a spectral discriminator for isolating at least two wavelength bands of the radiation prior to transmission of the radiation through the flow;

a detector for detecting radiation transmitted through the flow; and

a processor for evaluating transmission of the wavelength bands through the flow to determine physical and/or chemical changes of the CMP slurry.

REMARKS

The Applicants appreciate the courtesy of a telephone interview by the examiner with the undersigned attorney on March 12, 2001. In the interview the attorney argued that the dismissal of the Declaration filed with the previous response and the rejection of the Applicants' arguments on the basis that "an optically dense medium" was not recited in the claims, and on the basis that an "undiluted slurry" was not in the claims, was not proper because "a slurry as used in a chemical mechanical planarization process" must be optically dense and must be undiluted, as discussed in the specification at the top of page 7. The examiner was not convinced that this was so. The attorney asked that if the claims were amended so that it was absolutely clear that all that was intended to be covered was an undiluted optically dense slurry, would the claims be allowable. The examiner indicated that he thought the claims so amended would be allowable. The only independent claims, claims 1 and 26, have been so amended.

The examiner has rejected claims 1 – 4 and 17 under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 4,373,807 issued to Gerard Gouesbet

(hereinafter "Gouesbet"). This rejection is respectfully traversed. Gouesbet discloses that the apparatus described therein can be applied to measurements in furnaces, in flames, in combustion engines and at the outlet factory chimneys. See column 5, lines 46 – 51. There is no mention or suggestion in Gouesbet of transmitting light through an undiluted optically dense CMP slurry as claimed in claim 1. Neither furnaces, flames, combustion engines nor outlets of factory chimneys include optically dense medium. In fact, all of these are inherently relatively transparent. Thus, one of ordinary skill in the art would never look to Gouesbet as the solution to the problem of measuring changes or evaluating an undiluted optically dense CMP slurry; therefore; claim 1 cannot be obvious over Gouesbet. Claims 2 – 4 and 17 depend on claim 1 and include all its limitations, and therefore are also patentable.

The examiner has rejected claims 26, 29, 30, and 33 under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 5,422,712 issued to Shinichi Ogino (hereinafter "Ogino"). This rejection is respectfully traversed. Ogino discloses that the apparatus described therein is used for analyzing liquids such as blood and urine. See column 1, lines 6 - 10. There is no mention or suggestion in Ogino of transmitting light through an undiluted optically dense CMP slurry as claimed in claim 26. Urine and blood are not optically dense liquids. No one of ordinary skill in the art would think that a method that was used for analyzing urine or blood would be useful for analyzing undiluted optically dense CMP slurries. In addition, Ogino relates to a fluorescence method which does not detect transmitted radiation as claimed, but rather detects emitted radiation. One skilled in the art reading Ogino would try fluorescence, not transmission measurements, and thus Ogino heads one skilled in the art away from the invention. Thus, Ogino cannot make claim 26 obvious. Claims 29, 30, and 33 depend on claim 26 and include all its limitations, and therefore are also patentable.

Claims 5 – 16 and 18 – 25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gouesbet in view of "Commercial spectrophotometer for particle sizing" by Fabio Ferri et al., in Applied Optics Article No. XP 000685215 (hereinafter "Ferri et al."),

United States Patent No. 4,338,030 issued to Hendricus G. Loos (hereinafter "Loos"), United States Patent No. 4,318,180 issued to Lundqvist et al. (hereinafter "Lundqvist et al."), United States Patent No. 5,379,113 issued to Takeshi Niwa (hereinafter "Niwa"), and "Analysis of particle sizes, concentration, and refractive index in measurement of light transmittance in the forward-scattering-angle range", by Anatoli P. Nefedov et al., in Applied Optics Publication No. XP 00685510 (hereinafter "Nefedov et al."). (Note that the examiner refers to this reference by the first name of the first author, i.e., "Anatoli"). This rejection is respectfully traversed.

As mentioned above, Gouesbet does not disclose transmission of light through an undiluted optically dense CMP slurry. Further, an essential feature of the Gouesbet disclosure is that the particles through which the light is passed exhibit Brownian motion, which can only be detected in a medium that is not optically dense. See column 3, lines 4 – 9. Ferri et al. discloses a spectrophotometer for measuring polystyrene particles suspended in water, and refers to various applications, such as atmospheric aerosols and combustion exhausts, all of which are transparent or nearly transparent mediums. See page 885, the abstract and the second sentence under the *Introduction*. Loos is applied to suspensions of particles in a gas or a liquid, such as water drops suspended in air, such as clouds and fogs. See column 1, lines 21 – 25 and 56 – 58. Lundqvist et al. states that the apparatus and process of its disclosure is used to measure fibers in fiber suspensions which are used as starting material for the manufacture of paper, which is in the geometric optics regime. CMP slurries consist of sub-micron particles, in the Mie optics regime. See the Declaration, paragraph 10. The measurement and analysis techniques are totally different in these two regimes. Niwa discloses that the system described is used for determining particle size distributions of powdery solids suspended in air. See column 1, lines 26 – 35 and lines 59 – 62. This again is an inherently transparent medium. Nefedov applies the disclosed apparatus to measuring the properties of polystyrene-latex particles suspended in distilled water. See page 1363, the first paragraph under part 1B. It is specifically indicated that the particles are weak absorbing. See page 1365, the first

paragraph under part 4.

Claims 5 – 16 and 18 – 25 all depend on claim 1 and contain the limitation that the radiation is transmitted through an undiluted optically dense CMP slurry. One skilled in the art would recognize that the mediums to which all of the above systems, and in particular, the Gouesbet system, are applied are transparent or nearly transparent mediums, and therefore would not think that it could be applied to an optically dense medium such as a CMP slurry. See the Declaration, paragraphs 5 – 16. In fact, in view of the number of references that the examiner applies, none of which suggest that an optical measurement system can be used with an optically dense medium, such as a CMP slurry, makes a convincing case by itself that the invention as claimed is non-obvious.

With regard to claims 5 – 7, the examiner states that the present application states on page 28, lines 15 – 16, that the step of determining the slope of a logarithmic of transmission as a function of wavelength is known in the art. This is not correct. The application only says that one skilled in the art knows how to calculate slopes of curves. Of course, everyone with any technical background at all can calculate a slope given a figure such as FIG. 12A. This does not mean that incorporating such a calculation into a light transmission measurement process is known in the art. For this reason, claims 5 - 7 are not obvious over the cited art on this basis also.

With regard to claims 8 - 9 and 15, Ferri et al. describes an extinction apparatus (see page 886, the first sentences in parts 2 and 3), while Gouesbet describes an apparatus that analyzes the beating of a diffused beam with itself. See column 3, lines 16 - 17. These are very different optical devices, and there is no reason to combine one with the other. Thus, claims 8 and 9 are patentable on this basis also.

With regard to claims 10 – 14, the examiner's statement that these claims are obvious because the Applicant "has not disclosed that having such a diameter would solve any specific problem or for any particular purpose" is not only wrong, it turns the patent law on its head. The patent law requires the examiner to find a reference that shows the disclosed claimed property. If the examiner cannot establish a prima facie case of

obviousness, Applicants do not have to do anything more than disclose the device as claimed. Thus, claims 10 – 14 are patentable on this basis also.

With regard to claims 23 - 25, Nefedov et al. describes a scattering and absorption apparatus (see page 1357, the first sentence in part 1), while Gouesbet describes an apparatus that analyzes the beating of a diffused beam with itself. See column 3, lines 16 - 17. These are very different optical devices, and there is no reason to combine one with the other. Thus, claims 23 - 25 are patentable on this basis also.

Claims 27 - 28 and 31 - 32 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ogino in view of Loos and Niwa. This rejection is respectfully traversed. As indicated above, Ogino discloses that the apparatus described therein is used for analyzing liquids such as blood and urine, Loos is applied to suspensions of particles in a gas or a liquid, such as water drops suspended in air, such as clouds and fogs, and Niwa discloses that the system described is used for determining particle size distributions of powdery solids suspended in air. Nothing in any of the references suggests that the apparatus and process disclosed can be applied to an optically dense medium such as an undiluted CMP slurry. In addition, Ogino relates to a fluorescence method which does not detect transmitted radiation as claimed, but rather detects emitted radiation. One skilled in the art reading Ogino would try fluorescence, not transmission measurements, and thus Ogino heads one skilled in the art away from the invention. Thus, claims 27 – 28 and 31 – 32, all of which depend on claim 26 and contain the limitation that the radiation is transmitted through a CMP slurry, are patentable.

With regard to claims 27 and 28, the gratings of Loos are used to separate components of the light after transmission and fluorescence (see FIG. 1 and the Abstract), while in the present application, they are used to separate the components of the light prior to transmission. One does not make the other obvious; thus, claims 27 and 28 are patentable on this basis also.

For the above reasons, claims 1 – 33 are patentable and their reconsideration and allowance are respectfully requested. No additional fee appears to be due. However, if

any additional fee is due, please charge it to the Deposit Account No. 04-1697.

Respectfully submitted,
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By: _____

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